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THE FOREST FRONTIER AND SUBARCTIC[†]

W. C. Wonders

The evolution of Canada has taken place primarily in a forested landscape. Significant portions of the nation's total area, such as the Arctic, the southern portions of the Prairie provinces and some interior valleys of British Columbia were not forested in their natural condition; yet settlement in Canada has been essentially a struggle against the forest. So strongly has this attitude been ingrained that it delayed settlement on the open plains, and then handicapped it for fifty years with many farming attitudes carried over from the more familiar environment. As more and more land was taken up in settlement, the "forest frontier" was pushed back. Today, though much of the nation's surface originally was forested, the Subarctic represents the core of forested Canada.

Only in the USSR can a comparable extent of forest be found in these latitudes. The seemingly endless extent of the Canadian boreal forest stretches for hundreds of miles with little interruption. In the southern margins of the region, bordering central Canada, relics remain as reminders of the magnificent pine forests which originally extended into the region. On its northern borders the spruce trees thin to single spacing surrounded by a cushion of moss and lichens before shrinking dwarf-like, to extend final fingers of survival along the valleys into the Arctic. Yet everywhere the forest is not only present, but is inescapable. Most of it could scarcely be termed magnificent, in the sense of towering grandeur of the Pacific coastal forest or of the original pineries. Many are more likely to describe it as "monotonous".

[†] *The area here included is rather more extensive than the Subarctic in the strict definition of the term—for example, the Kenora, Lakehead and Sault sectors of Ontario. For the sake of brevity, however, the word "Subarctic" will be used in referring to the region hereafter.*

* W. C. Wonders is a Professor of Geography at the University of Alberta.

Except in the northwest, where this region overlaps into the Cordilleran region, relief rarely provides much significant variation in the landscape. The most noteworthy exceptions include the Laurentides Scarp, the Laurentians, Thunder Bay area and the eastern arms of Great Slave Lake and Great Bear Lake—all in marginal parts of the Canadian Shield.

Forest, rock and water—these are the three strongest landscape impressions of the Subarctic. It is the third element which provides the greatest variation in the local scene. Essentially the heritage of recent glaciation, water abounds over most of the region. It occurs as water bodies of every conceivable shape and size, from small ponds to some of the largest lakes in the world. It spills from one to the next in swift, dashing streams, and sweeps along in major rivers which reach such proportions that in the case of the Mackenzie, the width of its lower reaches is measured in miles. Rapids and falls are common features on almost all rivers in the Subarctic and their absence from the Mackenzie (though not from its tributaries) sets it apart. Relief in the main is subdued and the ever-present forest denies the sweeping vistas of the Prairies. Here, in travelling through the region, man's curiosity from the beginning has been piqued not so much by speculation as to what lies beyond the hill or mountain, but rather by wonder as to what lies beyond the next bend of the river or lakeshore, or above or below the waterfall. Muskeg is an additional characteristic element in the Subarctic landscape. This widespread condition, neither exclusively water nor exclusively vegetation, reaches its maximum distribution in this region. Scientifically interesting as a stage in ecological succession, it is one of the most unattractive features to most humans. The positive features it offers in the form of berries, hay and animal browse are far outweighed by the difficulties it poses in summer for overland movement, and by the insect haven it provides. Mosquitoes, black flies, no-see-ums and a myriad of similar insects which may be nuisances of varying degrees in other regions of Canada become an inescapable torment for animals and humans alike during the Subarctic summer. Muskeg would be far more troublesome were it not for the long-continued winter season in the Subarctic region.

The Canadian winter is to many the dominant feature of this nation,[1] and within its boundaries, the Subarctic provides the most severe example. Winter comes early and stays late. Water surfaces freeze and the entire landscape becomes snow-covered. Between the Arctic and Subarctic winter there is little to choose: if the Arctic experiences a rather longer season, the Subarctic's winter at least in the northwest is generally as cold with even lower extreme minimum temperatures. The northwestern parts of the Subarctic are in sufficiently high latitudes that winter is also marked by an extended period of daily darkness. A true summer does occur, however, with long daylight hours and often decidedly hot temperatures, permitting rapid development of both plant and insect life. Yet summer is but a short interval before winter returns. Discontinuous permafrost underlies much of the Subarctic, especially in the northwest. East of Hudson Bay it occurs mainly in the central part of the Labrador Plateau (Figure 14-1).

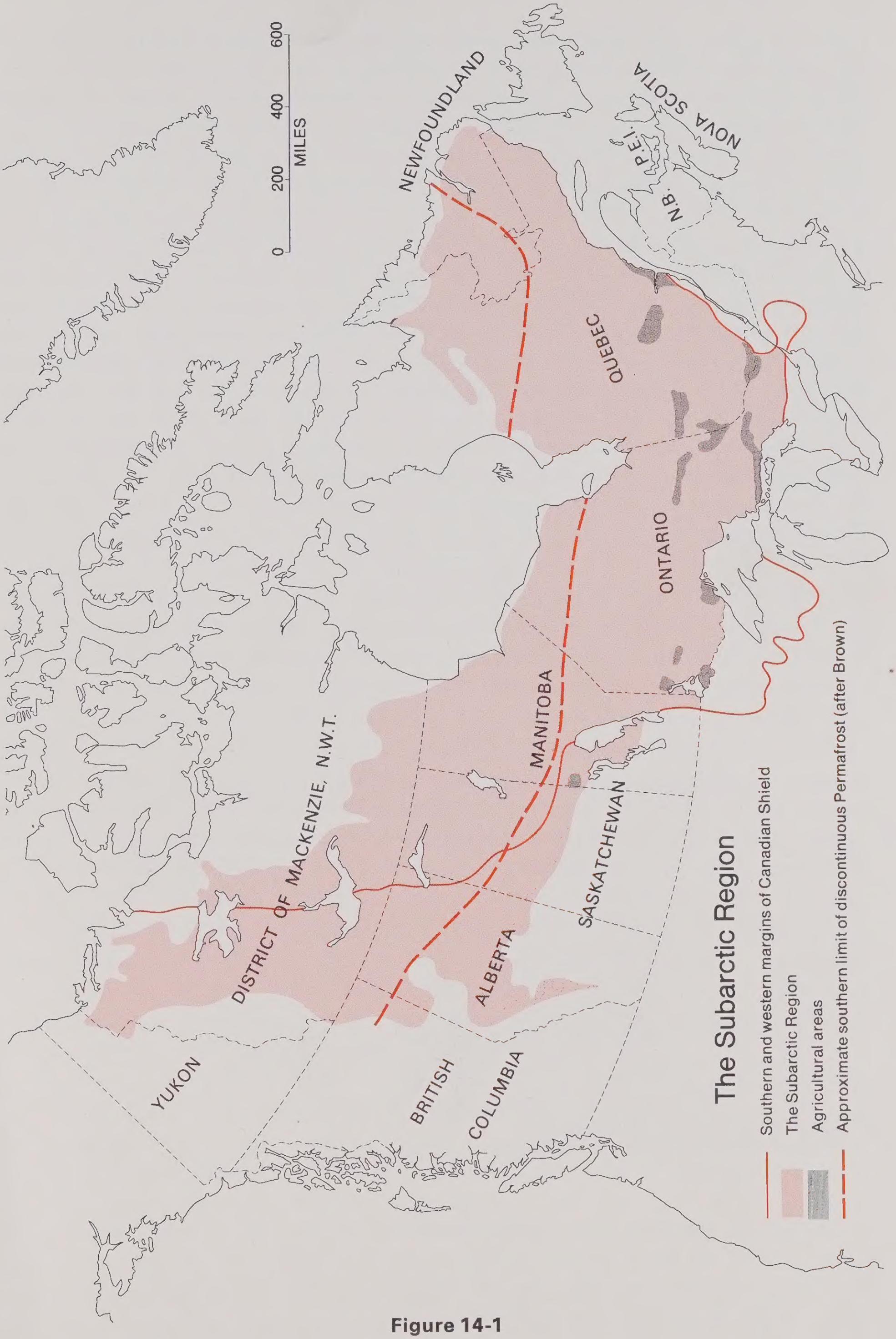

The Subarctic Region
Southern and western margins of Canadian Shield
The Subarctic Region
Agricultural areas
Approximate southern limit of discontinuous Permafrost (after Brown)
0
200
400
600
MILES
NEWFOUNDLAND
NOVA SCOTIA
P.E.I.
N.B.
QUEBEC
ONTARIO
MANITOBA
SASKATCHEWAN
ALBERTA
DISTRICT OF MACKENZIE, N.W.T.
YUKON
BRITISH
COLUMBIA

Figure 14-1

In this natural landscape man finds himself essentially an intruder, whereas elsewhere in southern Canada he has strikingly altered his surroundings. In the north, however, man is still present in small numbers considering the vast area; even including transitional southern areas, the population totalled less than 1.5 million in 1961 (Table 14-1). A significant difference between Arctic and Subarctic is that the bulk of this northern population lives in the Subarctic region. Most of the northern population lives in four areas of the two central provinces—the Lake St. John district, northwestern Quebec, northeastern Ontario and the Lakehead-Kenora-Rainy River districts west of Lake Superior. Elsewhere great distances separate the isolated areas or nuclei of settlement, and it is not too great an exaggeration to describe much of the region as uninhabited. Gadja has divided the Subarctic into two zones (called by Watson, the "Near North" and the "Mid North") largely on the basis of population numbers and patterns, and of resource development. Hamelin also recognizes two sectors within the Subarctic which he terms "Pseudo-Nord" and "Moyen-Nord", based on indices derived from selected factors. Internal refinements within the Subarctic thus may be made but against the southern Canadian backdrop, all these settlement areas are small. Their importance is generally much greater than population would suggest, however. Most represent outliers of southern Canadian development concepts of varying historical eras. Some have been successful, some not, with most falling between the two extremes. Many based on mines have been comparatively short-lived, yet their contribution to the total Canadian economy has often been very significant.

TABLE 14-1

POPULATION OF THE NORTH, 1961 (in thousands)*

Northwest Territories	23
British Columbia	3
Alberta	50
Saskatchewan	21
Manitoba	50
Ontario	711
Quebec	570
Newfoundland, Labrador	14
Total	1,442

*excludes Yukon Territory and the bulk of northern British Columbia which are included within the Cordilleran Region.

Figures from 1961 *Census of Canada.*

Though the Subarctic does possess distinctive characteristics, it does not possess a core area in the sense that many other regions in southern Canada do. Its broad longitudinal extent, stretching almost across the width of the nation, lacks any single natural focus within the region.

The boundaries of the Subarctic region are not sharp everywhere (Figure 14-1). On the north, as noted, the tree-line separates it from the Arctic. From the Mackenzie Delta it retreats far to the southeast around Hudson Bay and beyond in New Quebec and Labrador. Tree-line is at best an approximation, for on the ground the interpenetration of trees and tundra and the outliers of each occurring within the other rarely show up as a line at all but rather as a transition zone of varying width and complexity.

The southern boundary of the Subarctic coincides with the southern limit of the Canadian Shield for much of its extent from the Gulf of St. Lawrence to southeastern Manitoba. On either side of the boundary there are sectors in both Ontario and Quebec where characteristics of the other adjoining geographical region are strongly developed. If the north is reflected in many features of the Haliburton highlands and Frontenac axis of Precambrian southern Ontario, so too aspects of southern Quebec penetrate northward into the Subarctic, along such valleys as the Gatineau and the St. Maurice.

From southeastern Manitoba the boundary with the prairie region is an irregular transition zone rather than a sharp line, often referred to as the pioneer fringe. The Subarctic lies north of the areas of relatively continuous settlement, trending northwest to the boundary of the Cordilleran region.

The Subarctic region may be regarded as a cultural watershed today, between settled Canada to the south and uninhabited Arctic Canada to the north. The broad east-west sweep of the region dominates the map of Canada. Though overshadowed by more southerly regions in most other ways, it can be suggested that it is the Subarctic which gives the nation much of its distinctive character. The regions to the south in varying degree reflect much the same regions in the United States, save perhaps southern Quebec. Though Canada is a northern nation, more than two thirds of all Canadians live within 100 miles of the United States border.[2] Most Canadians see something distinctively Canadian in the north, not so much in the Arctic which still remains a strange, remote environment for the majority, but rather in the Subarctic. Forest, rock, water—these are the elements which exert a near-irresistible call for most Canadians. Even if most of the year is spent in a very different setting, the traditional northern ingredients are sought out for rest and relaxation. Though they may live to the south of it and rail against its harshness, many Canadians probably find in the Subarctic the "emotional heartland" of their nation.

The Subarctic region in eastern Canada lies between two of the major gateways or natural lines of European penetration into the heart of the continent, Hudson Bay and the St. Lawrence Valley. Westward the Mackenzie valley offers a third natural routeway. Save for some probable use of the latter by aboriginal man in his initial movements into the continent and its recent role in northern development, it has never been a significant rival, opening as it does on to the Arctic rather than the Atlantic. Rivalry between Hudson Bay and the St. Lawrence, in contrast, was very keen in several fields: political, military and economic. One hundred years before Confederation, the political and military issues were settled, but a further half century elapsed before the economic rivalry appeared to be decided.

The triumph of the Hudson Bay gateway and the company which bore its name appeared confirmed by the 1821 amalgamation with the St. Lawrence-based North West Company. The following decades were to prove the reverse, however.[3] During these years, rival traders, small but seemingly in never-ending succession, probed northward from the St. Lawrence River-Lower Lakes region particularly up the valleys of the St. Maurice and Ottawa rivers, and also northwestward from the United States. Attempts to block out opposition by leasing the King's Posts on the St. Lawrence watershed of Quebec and by underselling competitors westward could only be a delaying action. The critical development had been the expansion of the Canadian population to a point where it sought to expand its ecumene beyond the St. Lawrence Lowland. In eastern Canada the expansion was reflected in inroads into the Subarctic fringe by settlers and by lumbermen. These established themselves in small communities eastward along the Côte Nord as far as Sept-Iles by mid-century, and fishermen-hunters located beyond. By the 1850's and 1860's settlers were established on the Lake St. John plain. A similar movement of lumbermen and settlers was pushing back the forest frontier up the Ottawa Valley. At the same time the inhospitable nature of the rocky Shield for agriculture was recognized and the contrasting great potential of the Prairies in the northwest, then controlled by the Hudson's Bay Company. Viewing these latter as a natural outlet for the surplus population of the east, caught up with an expansionist fervour for a grand political dream, and fearful of the vigorous neighbour to the south, the holders of the St. Lawrence gate were to triumph after all.

The year 1867 marks not only Confederation for Canada, but also a time of major change in official policy and economic conditions for the Subarctic. The Hudson's Bay Company, recently reorganized, was in a transition stage which saw its end only two years later in the surrender of Rupert's Land and the Company's special privileges to the new nation. Henceforth the Subarctic would no longer be guarded for the production of furs alone, but was available for development of other elements of its potential. How much of that potential has been realized to date remains a much debated subject. Certainly it has resulted in greater change in the Subarctic than occurred during its entire previous history.

The Subarctic of today has primarily been shaped by the development, in varying degree, of four resources—agriculture, forests, minerals and water power—and by transportation changes throughout the region. In each case the inherent geographic characteristics have been major factors in the degree of development or lack of it. The principal elements have been the predominance of the glaciated Canadian Shield, the long severe winters, the boreal forest and its associated podzol soils, the vast distances, the limited transportation facilities and the continuing sparse population. So long as fur was the only resource to be utilized, most of these elements were favourable to a greater or lesser degree. The product, light and of high value, could be transported over great distances with minimal investment in transportation equipment. Other potential resources remained generally

The Unplanned Early Frontier: Dawson in Yukon Territory (64° N) had population of 9,142 in 1901 during the gold rush days. In 1961 the population was 881. (National Film Board: Photo by G. Lunney.)

undeveloped, partly because of the remoteness and limitations of the region, and partly because population pressures and market demands outside the region had not grown sufficiently. The subsequent increase in these pressures and demands led to the utilization of more of the regional resources. Bruce and Watson[4] suggest that what hitherto had been a negative barrier area in Canada evolved through this change into a positive area linking east and west. Certainly its contributions to the economic life of the nation have increased and diversified. This has been possible only with very large investment capital to provide the physical plant and transportation facilities required for development, and these in turn have required a very large assured market. In most cases this market has been the United States.[5] In the case of the Subarctic region, at least, continental economic units as compared with national or regional, have led to more rapid and more diversified development than would otherwise have been the case. However, the region still primarily remains a raw material producing area.

It is not possible to identify stages of geographical development within the entire Subarctic, because of the enormous area involved and because it is in contact with each of the other regions which often were developing at different stages. Conditions which have affected one part of the Subarctic have not always been the same in another distant part. As the entire region increasingly becomes part of a continental economic unit, this is decreasingly true. One condition is clear, however: the Subarctic long remained a frontier area where the individual was free to make his own way. He still can escape the presence of his fellow men to a large degree, but if he seeks the standard of living now considered minimal for the nation at large, he will require their assistance. This may come through private or government sources, or through both. There is general recognition today, however, that the solitary northerner carving out a future for himself is a romantic but outmoded concept. Similarly, that agriculture which provided the basis for settlement of much of southern Canada cannot be the basis for settlement and development of northern Canada.

Government always has been involved in the development of Canada both nationally and regionally. It has been relatively more involved in the development of the north and probably always will be. The limitations of the region are such that even large private companies may be discouraged by cost of necessary initial investments, especially in transportation. If the region is to be integrated with the rest of Canada, such investments will have to be made and often only government is able or prepared to assume the risk. In some cases, a government decision has produced a major change in northern economic conditions and settlement patterns—for example, the Ontario government's 1900 embargo on export of pulpwood to the United States and the post-World War II governmental development of education in the Northwest Territories. The division of the region amongst several political units does not help. This philosophy or policy of northern development may vary considerably from one unit to another, and decisions may be made for the political unit rather than for the geographic or economic region.

AGRICULTURE

The Subarctic region generally has not proved attractive to agriculture. Much of the surface was totally stripped of regolith and soil by glaciation. The pockets of morainic debris which did occur required exhausting labour to clear stones after the trees had been removed. Frequent ponds and muskegs interrupted the surfaces even then. The soil, typically a grey podzol, proved to be thin, inherently of low fertility, and usually cold and poorly drained. The lighter, sandier soils of kame or lacustrine origin soon were exhausted of organic matter and nutrients and were abandoned within a few years of forest clearing, or degenerated into rural slum areas. The short growing season was hazardous for many crops. In the more humid eastern half of the Subarctic late summer rains often seriously delayed or prevented hay drying and harvest operations, while in the west the much lighter precipitation made it all the more critical and drought proved to be a hazard for the few farmers in the region.

Despite these disadvantages agriculture penetrated into the Subarctic region, especially in the central sectors in the provinces of Quebec and Ontario. This movement began in Quebec, particularly in the Lake St. John area, well before Confederation. The 1850's also saw farmers and lumbermen both moving northward into the pineries of the Ottawa Valley. By the 1870's they were well established as far as Temiscaming and in the areas east and north of Georgian Bay and Lake Huron. The pressures for rural settlement by the French speaking Canadian of Quebec were greater than those on his English-speaking compatriot in Ontario. As the St. Lawrence area became fully taken up for agriculture, settlers sought out the portions of the Shield where agriculture was possible.[6] This movement was assisted and encouraged in Quebec by vigorous colonization societies frequently associated with the Church. When similar pressures developed in southern Ontario they were eased by emigration to the American Midwest, and also led to demands for the opening of the Fertile Belt in the Prairies.

In the first decade of the twentieth century agricultural settlement became part of government policy. While the first settlers had moved into the north by water (Little Clay Belt), trail (Lake St. John) and combination of water and trail (Rainy River), it remained for the railway to open up much of the area for agricultural settlement.[7] Federal authorities were mainly concerned with the developments on the Prairies. Both Ontario and Quebec fostered expansion into those parts of the Shield where prospects appeared better than normal. Such prospects in the region have been linked almost invariably with the proglacial lacustrine deposits as in the clay belts of northwestern Quebec, northeastern Ontario and northwestern Ontario, or with postglacial marine sediments as in the Lake St. John area and to lesser degree in the narrow, fragmented western sector of the Côte Nord. There were two periods of relatively active expansion, the first just before World War I and the second as part of a widespread "back-to-the-land" movement in the depths of the depression years of the mid-1930's. Winter work in the forest, usually cutting pulpwood, was an important associated activity. Mining centres helped provide local markets.

Since 1940, there has been not only a levelling off of agricultural expansion but actual regression in the Subarctic. The greater success of the Quebec settlement program as compared with the Ontario experience was reported as early as 1937 by Gosselin and Boucher.[8] They noted that "in Ontario, apart from the sale of farm lots to settlers at low prices, and the construction of colonization roads, very little has been done to encourage and assist land settlement or to induce settlers to clear and improve their farm lots and to become self-sustaining". In Quebec there were free grants for building houses and barns and for the purchase of equipment and livestock, land clearing bonuses in the early years, close supervision and advice by specialists, and an active Church in religious and social activities. The greater tendency toward group settlement in Quebec made for greater permanency than the isolated individual settlement in Ontario. Even after Ontario policy was altered to favour consolidated community settlement, a government committee reported in 1950 that the dispersion of settlement is still excessive, and that the difficulties imposed by nature on the development of virgin soil in the clay belt to a productive state of tilth and fertility demand that its settlement be on a community basis and avoid the individual frustrations that have occurred in the past.[9] Today, however, northern Quebec as well as northern Ontario reflects significant agricultural decline (Table 14-2). Although a slightly more restrictive definition of farm in 1961 probably affects the statistics

TABLE 14-2

AGRICULTURAL CONDITIONS IN SELECTED NORTHERN AREAS, 1951 AND 1961

				Condition of Farm Land (acres)							
				Improved					Unimproved		
	Farm Population	Farm Operators	Area of all Farm Land	Total	Under Crops	Summer Fallow	Pasture	Other	Total	Wooded	Other
Rainy River (Census Div 41)											
1951	6,068	1,371	312,699	90,294	59,708	5,920	20,047	4,619	222,405	112,873	109,532
1961	3,382	781	221,826	77,209	53,313	2,376	16,277	5,243	144,617	57,537	87,080
Kenora (Census Div 20)											
1951	3,781	551	117,420	28,226	19,855	904	5,882	1,585	89,194	64,566	24,628
1961	1,041	238	74,162	23,770	17,660	686	4,308	1,116	50,392	33,438	16,594
Cochrane (Census Div 5)											
1951	11,722	2,198	333,405	124,489	79,675	1,681	36,914	6,219	208,916	79,980	128,936
1961	5,320	900	187,166	81,471	54,161	1,079	21,807	4,424	105,695	41,945	63,750
Abitibi (Census Div 1)											
1951	38,627	6,959	846,292	290,171	196,689	2,204	72,207	19,071	556,121	261,167	294,954
1961	22,435	3,439	575,250	269,216	179,356	1,949	73,720	14,191	306,034	95,362	210,672
Lac St. Jean (Census Divs 32 & 33)											
1951	30,277	4,072	564,684	306,053	200,210	2,354	92,265	11,224	258,631	153,749	104,882
1961	22,153	2,940	501,333	296,527	187,348	1,349	97,607	10,223	204,806	117,603	87,203

TABLE 14-2 (Continued)

AGRICULTURAL CONDITIONS IN SELECTED NORTHERN AREAS, 1951 AND 1961

	Size of Farm (acres)											
	Under 3	3-9	10-69	70-129	130-179	180-239	240-399	400-559	560-759	760-1,119	1,120-1,599	1,600 & over
Rainy River (Census Div 41)												
1951	1	33	69	146	509	95	382	95	32	6	2	1
1961	—	1	22	67	208	73	237	116	45	10	2	—
Kenora (Census Div 20)												
1951	—	7	33	77	213	41	123	36	16	4	1	—
1961	2	4	5	20	52	21	76	31	15	11	1	—
Cochrane (Census Div 5)												
1951	2	27	120	771	870	119	217	48	16	7	1	—
1961	7	10	44	212	274	78	181	58	23	12	1	—
Abitibi (Census Div 1)												
1951	1	13	246	5,271	253	894	217	53	8	2	—	1
1961	1	3	82	1,608	247	964	416	110	6	1	—	1
Lac St. Jean (Census Divs 32 & 33)												
1951	1	15	511	1,966	568	585	350	62	10	1	—	3
1961	8	8	191	1,130	491	571	419	87	26	6	1	2

for that year, the decline in the farming population is striking. Such a trend is not unique to the north. Insofar as it represents rationalization of agriculture, with fewer but larger and more efficient units, it is desirable. A minimum of 300 acres per farm now is considered essential for an economic unit on the best land near Cochrane.[10] Clearly the decline mainly involves the smaller farms and the number of larger farms is increasing. Nevertheless, there is a general reduction in the total area of improved farm land. It must be conceded that agriculture in the north is generally in regression.

The agricultural areas of the Subarctic form a widely spaced pattern (Figure 14-1), involving mainly Quebec and Ontario. Only in the most favoured areas is the distribution of individual farms sufficiently consolidated that it conveys the impression of an agricultural landscape. Of the total of some 37 million acres of estimated land available for agriculture in northern Ontario and Quebec at the peak period of agricultural expansion in the 1930's,[11] over 30 million acres lay in the Clay Belt area[12] formed by proglacial Lake Barlow-Ojibway, and some 2.6 million acres in the Lake St. John area. In 1961, it was estimated that 10 million acres would seem to be a reasonably conservative figure for potentially arable land within the Shield.[13] Much of the potential arable land even within the clay belt requires major improvement before agriculture is possible. The Great Clay Belt has only 10 per cent of its area well drained, with 40 per cent moderately drained and 50 per cent poorly drained. Stoniness and depth of clay further limit the useful area.

Emphasis in agriculture is on mixed farming. Hay, oats and mixed grains bulk large to support dairy animals where local markets exist in the local mining and wood industry centres. Potatoes make up a reliable crop for most. If isolation reduces local markets it may encourage specialties—for example, alfalfa seed production in the Rainy River area—but such specialization is rare. Most of the farmers even in the best areas are part-time. The Glackmeyer Development Area immediately north of Cochrane is one of the best endowed areas, both in natural conditions and in accessibility and services. It has been open to settlement since before World War I, yet a half century later only 366 of a possible 584 lots have been patented or located. (Eighty-five per cent of the total area is considered arable.) Of the 133 families in residence only 38 per cent were actually deriving the whole of their livelihood by farming, 24 per cent were obtaining only part of their income by farming, and 38 per cent were using their lots only for residence and a source of fuel and pulpwood. In 1960 only 2 per cent of the holdings were rated as land well farmed and 24 per cent very poorly farmed; 51 per cent of the holdings were not farmed. In the larger setting, in the Cochrane Clay Belt, 1.5 million acres of land have been man-handled, yet only 50,000 acres have been sufficiently improved to be considered productive farm land.

Timber was considered to be a saleable commodity in the first stages of rural settlement, to give way to full-time farming. This has not happened, at least in the Cochrane Clay Belt. Clearing has not always provided an economic farm unit and the settlers have moved on. It is now suggested that the solution lies in implementing a multiple land use plan, wherein continuing forest, wildlife and recreation land use will be incorporated with the agriculture, and in larger farm units. By such methods stabilization of rural settlement may be achieved.

In the northwest, agricultural settlement has occurred along the southern margins of the Subarctic in the pioneer fringe of the Prairies but it never really has penetrated into the region proper.[14] Though the margin of the Shield recedes northward, all the other unfavourable features for agriculture persist and stand in marked contrast to the attractions of the adjacent Prairies. Unlike the eastern Subarctic, population pressures from the south did not reach a point where major inroads followed. Manitoba's northern clay belt, north of Lake Winnipeg, originated with glacial Lake Agassiz. Potentially arable land may be as much as 4 million acres, but negligible development has occurred as yet. Limited potential areas exist northward down the Mackenzie Valley but actual areas in cultivation have declined recently. Improved transportation has reduced the isolation of northern communities and their need for self-sufficiency. Begun late, facing major natural disadvantages, agriculture in the Subarctic cannot be regarded as a base for expanding settlement, at least in the foreseeable future.

FORESTRY

The boreal forest of the Subarctic offers in itself a major economic resource. This is particularly so in combination with the abundant water net which characterizes most of the region and which provides both the cheapest means of transportation and also a source of power for processing. Within this region of almost 1.5 million square miles, about one third is considered forest and barren on the northern margins and of no potential commercial value for forestry.[15] Two distinct stages have occurred in the utilization of Subarctic forests. The earlier, concerned with lumber, reached its peak development in the quarter century following Confederation and the first decade of the present century. The later, concerned with pulp wood, and with pulp and paper, has replaced it as the major focus of activity in the present century. Similarly spruce has displaced white pine as the major wood involved.

The best timber stands occurred in the marginal south central parts of the region, primarily in Ontario and Quebec, where they formed part of the Great Lakes-St. Lawrence forest region dominated by the white pine. As the more accessible stands were cleared, the lumber industrialists moved on northward and westward—cutting all the worthwhile timber, floating it downriver to a convenient mill site, sawing it into lumber, loading it aboard ships for market, taking the profits and moving on to the next available stand before a competitor obtained the cutting rights. The pattern was particularly striking in the Ottawa Valley, and on the shores of Georgian Bay and Lake Huron, though the large watershed of the Ottawa enabled the main mill bases to remain longer in one place than in the others.[16] With such a short-term outlook the lumbering era was mainly a passing phase in resource development in much of the east. It hastened the withdrawal of the Hudson's Bay Company and in this its interests coincided with those of the pioneer farmers. Thus the northward penetration of agriculturalists previously outlined was usually linked with lumbering. Not only did the latter assist in clearing the land for the farmer but it provided him with winter employment and a market for his crops.

The principal markets for lumber were the United Kingdom and the United States, and pine was the major wood exported. The British market continued a pattern which began early in the nineteenth century and was dominant in the province of Quebec. Though the United States possessed large white pine forests of its own, the great expansion of that country after the Civil War and the rapid depletion of its own sources created a voracious market for Canadian lumber centred mainly in New York and in Chicago. The Ottawa Valley, Georgian Bay and the north shore of Lake Huron were the main sources of supply. Wood export to the United Kingdom ranged between 10 and 15 million dollars a year and generally exceeded that to the United States—until 1903, when the United States increased spectacularly to its continuing dominant position. The total lumber industry increased about 1900, then declined until it was revived by production of lumber from the Cordilleran region.[17] White pine declined from 1881 and its history is essentially the history of lumbering in the Subarctic, with spruce generally playing a more recent but lesser role. The trade was organized by British, American and, after about 1856, Canadian capital. The economic unity of the politically-divided Great Lakes basin was never emphasized more than in the competition between American and Canadian companies in the latter part of the nineteenth century as each sought to control the flow of lumber to American markets. American firms towed Canadian logs to Michigan mills and also established some mills in Canada. The building of the Canadian Pacific Railway enabled the lumber industry to draw on some areas north of the watershed but was more important in opening the pine area between the lakehead and the Prairies, especially in the Lake of the Woods area.

In an expansive era little or no thought was given to the conservation of resources after lumbering moved on. Today, though numerous small portable sawmills operate in the southern Subarctic, only a few large mills remain as a reminder of a former era and some communities with no significant alternative employment have become near ghost towns (for example, along the north shore of Lake Huron). In general, the history of lumbering, not only in Canada but also in the United States, has been that few areas once opened have lasted more than twenty-five to thirty years.

The western sector of the Subarctic region possessed no original forest stands comparable with the eastern. Lumber for the building of the Prairies was initially supplied from the western edge of the pine belt. However, along the southern margins of the Subarctic adjacent to the Prairies, some significant stands did occur particularly in the Saskatchewan drainage basin. During the settlement era in the Prairies, mills based on such stands found a ready market for lumber. Many of these mills were financed by Minnesota capital.[18] Here, also, on a reduced scale, the same pattern of "cut and move on" took place, with only a few relics remaining amid the second growth timber in the pioneer fringe.

The regional lumber supply dwindled but a demand for pulpwood rose, particularly in the eastern United States. Proximity to that market which had proved so favourable in the lumber era was equally attractive again. Exploitation of the pulpwood resource in the present century has risen to remarkable levels in the past fifty years. About the time of Confederation two major technical innovations occurred—the first use of wood in pulping and the introduction of chemical pulping. By 1881 five wood pulp mills were reported by the Census in Canada, increasing to fifty-three by 1901. These were geared essentially to home demand, but the rapid growth of the United States market also was reflected in increased export of pulpwood. This grew ten-fold in the last decade of the nineteenth century, to over $900,000 in value. To protect the Canadian forests all other provincial governments followed Ontario's lead in 1900 of placing an embargo on exports of pulpwood cut from Crown Lands.[19] United States mills still could be supplied from privately owned land and some still are—for example, a Wisconsin Rapids mill relies heavily on pulpwood cut on the Ontario shore of Lake Superior and towed across to the south shore. When coupled with the United States government action in 1911 of permitting free import of Canadian newsprint, however, it spurred a major United States investment in Canadian pulp and paper mills. Both the number of mills and the volume of export to the United States increased dramatically (Table 14-3). Whereas most of the earlier Canadian mills were in the more southern parts of central Canada, as the companies increased in size and numbers they turned more and more to the forested source areas of the Subarctic.

TABLE 14-3

CANADIAN PULP AND PAPER INDUSTRY, 1900-1960

	1900	1920	1940	1960
Number of mills	53	100	103	128
Employees	6,236	31,200	34,719	65,642
Value of output (millions $)	8.6	236.4	298.0	1578.7
Distribution of Shipments (% of value)				
To Canada	79	31	38	42
To U.S.	14	57	45	47
To other countries	7	12	17	11

Source: DBS.

The coming of pulp mills to the Subarctic marked a new phase in regional settlement. Scientific forestry with sustained yields and *tree cropping* attitudes replaced the former *mining* approach. It was specified by government authorities as one of the requirements for leases of forest land which largely remained in Crown ownership.[20] Large forest holdings were required because of the slower growth rate of the forests, particularly as compared with those on the Pacific coast. Paterson's CVP-index (climate-vegetation-productivity) to assess the plant growth ability of a climate takes into account only one factor in vegetative productivity but suggests interesting ratings for the two regions (Table 14-4).[21] On a broader base, the comparative ratings in Table 14-5 bring out the same contrast between the two areas and the much more favourable natural productivity of the Pacific coast.[22]

TABLE 14-4

POTENTIAL FOREST PRODUCTIVITY, PACIFIC COAST AND SUBARCTIC

Selected Station	CVP — Index
Pacific Coast	
Vancouver	862
Clayoquot, V.I.	2,370
Bella Coola	370
Prince Rupert	1,412
Subarctic	
Ft. McMurray, Alta.	90
Beaverlodge, Sask.	70
The Pas, Man.	45
Churchill, Man.	31
Kenora, Ont.	99
White River, Ont.	93
Cochrane, Ont.	100
Chicoutimi, P.Q.	106
Mistassini Post, P.Q.	92
Clarke City, P.Q.	146

Source: S. S. Paterson, *The Forest Area of the World and Its Potential Productivity.*

With a large capital investment represented in each mill, the companies involved committed themselves to long-term residence. The mills generally located at the mouths of southward-flowing rivers for pulpwood assembly and on navigable water for shipment where possible. Hydroelectric power sites also made river locations important in the beginning to avoid power loss in transmission. Those mills in northern Ontario north of the watershed relied entirely on the railway for distribution of their product.

A considerable staff of varying skills was required to operate each mill. The companies were anxious to minimize labour turnover and expensive retraining, so they sought to provide as pleasant living and working conditions as possible. The result was the development of company towns, planned communities designed to provide complete facilities for the inhabitants—for example, Clarke City, Baie

Comeau, Iroquois Falls, Smooth Rock Falls. The quality of housing and amenities varied from adequate to outstanding. Many provided conditions considerably in advance of those available in most cities in southern settled Canada. It must be acknowledged that a certain element of almost feudalistic social class distinction sometimes occurred, and at times a certain resentment toward the company town and its favoured inhabitants was felt by other local residents. Similar communities also were developed by some mining companies, though more often only for the relatively permanent smelter operations rather than for the mines.

TABLE 14-5

NATURAL PRODUCTIVITY OF ACCESSIBLE, PRODUCTIVE FOREST LAND

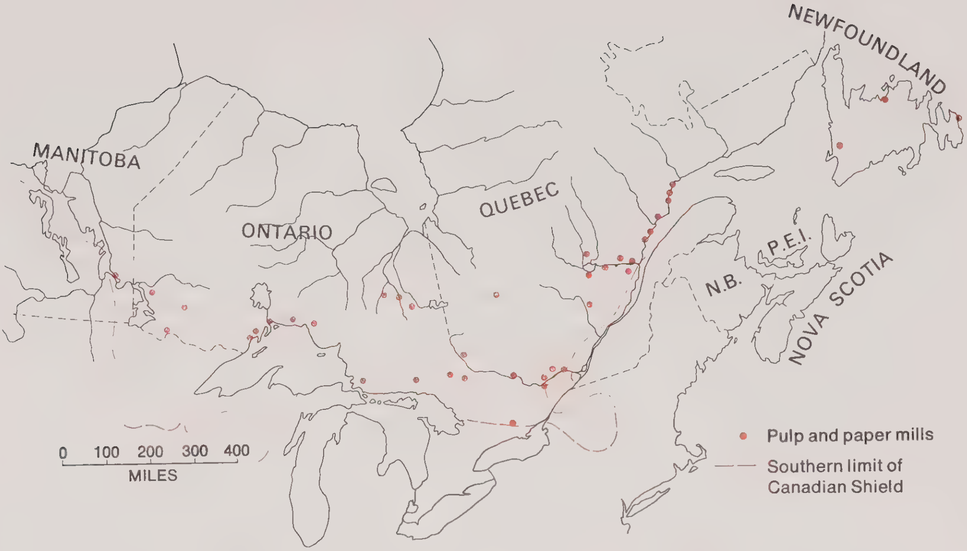
	Natural Productivity of Softwood per acre per year (cu. ft.)
Newfoundland, Labrador	17.0
Quebec	22.6
Ontario	14.2
Manitoba	9.5
Saskatchewan	7.0
Alberta	19.4
N.W.T.	8.6
British Columbia, Coast	35.3

Source: D. V. Löev, *Potentialities of the Forest Resource Base.*

Today many communities in the Subarctic are directly dependent upon pulp and paper, which for many years has been Canada's leading industry.

> It stands first among all industries in value of production, exports, total wages paid and total capital invested. It is the largest consumer of electrical power and largest buyer of goods and services in the land. The industry has a newsprint capacity of more than three times that of any other country and provides nearly 50 per cent of the world's newsprint needs. Canada stands second only to Sweden as the world's largest pulp exporter and second to the United States as the largest pulp producer.[23]

Quebec and Ontario between them account for about three quarters of Canadian production and rank in that order. Much of the processing occurs in the Great Lakes-St. Lawrence region, however, in mills that draw their raw materials from the Subarctic to the north. The great mill complex along the lower St. Maurice River is a good illustration. The concentration of mills in the central provinces reflects the major market in the southern part of that area and in the nearby parts of the United States. The pattern brings out the importance of location on navigable water and/or on railways, and of locally available hydroelectric power. Many communities besides the mill towns are dependent upon the pulp and paper industry. Along the Côte Nord, for example, some eight ports ship pulpwood to



Pulp and paper in the Subarctic, 1965

Figure 14-2

mills up-river. Cutting and moving pulpwood to the mills provides both permanent and seasonal employment, and sales of pulpwood from their properties often have been more important than crops for many farmers in the region.[24]

In the vast forested areas of the northwestern Subarctic, only one mill exists on the southern margin, at Hinton, Alberta, and this has been in operation only since 1957. The long rail haul necessary to reach distant markets, along with the slower natural productivity, have retarded development despite the best efforts of the residents of the settled portions of the Prairie provinces. Once again it is clear that resource development in this region demands major investments and assured major markets in order to succeed. Until such time as more favourably endowed areas are developed and demand grows sufficiently, the resources must remain potential. Announcements recently have been made indicating the beginning of this phase of forest development at such points as Whitecourt (Alberta), Prince Albert and The Pas. Significantly, foreign capital is heavily involved in the projects. Pulp and paper mills will be set up, but it seems unlikely that total output will ever rival that of the eastern Subarctic.

Finally it should be noted that the forest development of the Subarctic has played a role in the conception of the Canadian character. Work in the bush and life in the shanties were experienced by many Canadians at an earlier stage in history. If much of the work was hard and cold during the long winter while trees were felled and dragged to ice-covered streams to await break-up, it promised the exhilaration of the spring drive down the swollen stream and the wild annual spree in the towns (including the national capital) when paid off after the drive. It enriched Canadian literature and folk music. Today's forest workers are fewer in number, tend to be increasingly year-round employees, using chain saws in place of axes and bucksaws and tractors or trucks in place of horses, but they carry on a traditional role.

MINING

Mineral resources today are second only to the forest in the economic life of the Canadian Subarctic. The prevalence of the Shield through most of the region, which provided such an unfavourable foundation for agriculture, was counterbalanced by prospects of metallic minerals. Such prospects primarily are associated with the relatively small areas of folded volcanic and sedimentary rocks widely distributed through what otherwise is mainly a granite and granitoid gneiss mass. Certain areas of the Subarctic Shield appear to be more mineralized than others (Figure 14-3 and Table 14-6). Not all subregions are presently supporting mines. "Most of the more accessible islands (of volcanic and sedimentary rocks) have been prospected with some degree of thoroughness by conventional methods, so it is safe to assume that most of the easily discovered deposits of minerals are known."[25] Further discoveries will be increasingly expensive, requiring specialized prospecting equipment.

Development of significant mines has been linked closely with improved transportation facilities, traditionally rail. It was construction of the Canadian Pacific Railway through the empty barrier of the Shield which led to the discovery and development of the world's major nickel source in the Sudbury basin of northern Ontario (copper and platinum also being recovered). Whereas this occurred in the 1880's, the major development of Subarctic mining has occurred in the present century.

TABLE 14-6

MINERALIZED AREAS WITHIN THE CANADIAN SHIELD

(after Lang, *Prospecting in Canada*)

Geological Regions	Sub-Region	Principal Minerals
Slave	Great Bear	uranium, silver, copper, cobalt, nickel
	Yellowknife	gold, tungsten, beryl, columbite, spodumene
	East Arm	copper, lead, zinc, uranium, nickel, cobalt
	Taltson	uranium, base metals
Churchill	Athabasca-Rankin	uranium, gold, cobalt, nickel, vanadium
	(Churchill-Nelson)	copper-zinc, nickel
Superior	(West Lake)	gold, iron, copper-zinc-silver
	Timiskaming	nickel, copper, gold, zinc, iron, uranium
	Labrador Trough	iron
Grenville		iron, titanium, zinc, lead

Gold and silver were important early in the mining development of the Subarctic, and continue so, but it has been the growing demand in the present century for industrial minerals which has resulted in major mining activity. Steel and ferroalloys particularly are required in an age of increasingly complicated and specialized machines. The postwar near-explosion of iron mining in the Canadian Subarctic to meet United States needs has elevated Canada from a non-producer between 1924 and 1948 to the position of the world's fourth largest producer and largest exporter of iron ore (over 38 million short tons in 1964).

Ironically, it was construction of the Timiskaming and Northern Ontario Railway for agricultural colonization by the Ontario government that started major mineral development after the turn of the century. These two economic activities can complement one another, but the greater immediate financial attractions of mining may have a disruptive effect upon the other at times, especially among young people. In any event there emerged a major mining region in northeastern Ontario and subsequently in adjacent northwestern Quebec. It has come to be regarded as the fountainhead of Canadian hard-rock mining. Though Montreal particularly had profited from the opening up of the Prairies, Toronto established its dominance in northern Ontario and even northwestern Quebec, through the TNO Railway and financing for the mines. Large amounts of capital were necessary for exploration, engineering and development; Toronto provided the financial centre for this and has retained this role to the present.

Beginning in 1903 with the Cobalt silver discovery, an entire succession of developments occurred in the area—in 1909 Porcupine gold centred on Timmins, in 1911 Kirkland Lake gold, and in 1925 Larder Lake gold (though claims were staked in the latter two fields as early as 1906). On the Quebec side of the provincial boundary mineralization continued eastward and resulted in the 1921 discovery of the Noranda-Rouyn copper-gold, and in 1937 of the Malartic-Val d'Or gold. All fields continue to produce, though the gold mines require government financial assistance and those in Ontario are beginning to close with exhaustion of ore. At the same time the post-World War II development of asbestos near Timmins and the 1964 spectacular discovery of a major zinc-copper-silver ore body near the same centre exemplify the unpredictable nature of the mining industry.

The gold mines between Lake Nipigon and Lake Winnipeg illustrate the importance of technological change in transportation. There had been mines close to Kenora in the 1880's and 1890's accessible to the railroad, but they were soon exhausted. Improvement of the gasoline and diesel engines in their various applications made possible the development of Red Lake, for example, in 1925, even though it was removed from the railway. Aircraft, boats and tractors all played an important role. The same was true in the early stages at Noranda and Flin Flon, and also in the Mackenzie Valley.

Foreseeable exhaustion of the high grade Minnesota iron deposits led to the 1944 development of the Steep Rock iron deposit 130 miles west of the lakehead. Though iron had been developed earlier in the Michipicoten area north of Sault Ste. Marie and enabled that city to become the third centre of primary steel production in Canada, increased production began after World War II. Northwest of

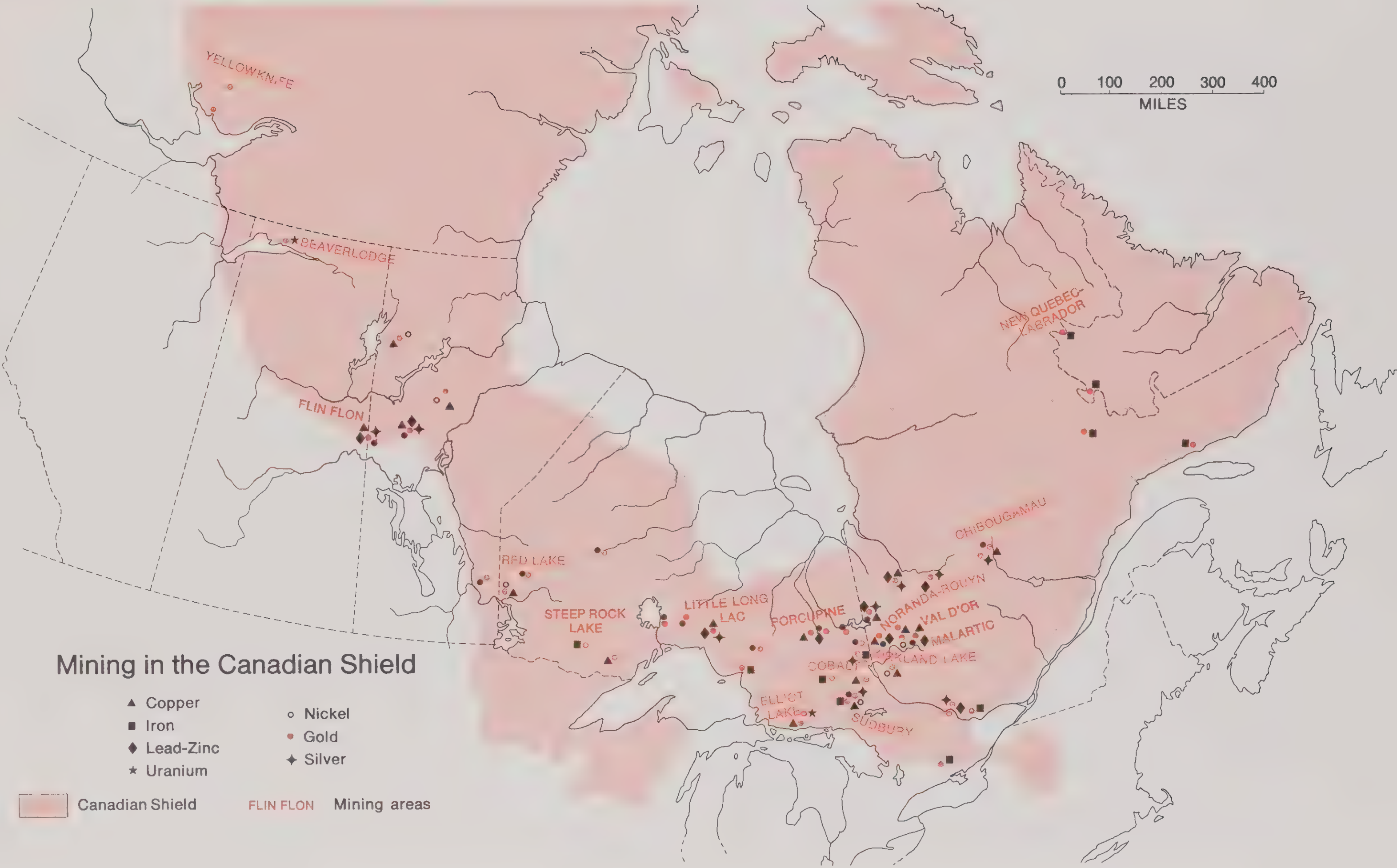

Mining in the Canadian Shield
▲ Copper
■ Iron
◆ Lead-Zinc
★ Uranium
○ Nickel
● Gold
✦ Silver
Canadian Shield
FLIN FLON Mining areas
0 100 200 300 400
MILES
YELLOWKNIFE
BEAVERLODGE
FLIN FLON
RED LAKE
STEEP ROCK LAKE
LITTLE LONG LAC
PORCUPINE
NORANDA-ROUYN
VAL D'OR
MALARTIC
KIRKLAND LAKE
COBALT
ELLIOT LAKE
SUDBURY
CHIBOUGAMAU
NEW QUEBEC-LABRADOR

Figure 14-3

Michipicoten copper and zinc have been brought into production at Manitouwadge. The most spectacular rise and fall of a modern mining area was that experienced by the Elliot Lake uranium area 15 miles inland from Lake Huron's North Channel. The area possesses some 93 per cent of Canada's huge uranium resources, as compared with 6 per cent in the Beaverlodge area of northern Saskatchewan.[26] Developed as a model modern mining community in the 1950's, Elliot Lake went into near-fatal decline when the United States market for uranium ended at the close of that decade. Until the market improves the area lies almost dormant, again pointing up the uncertainty of development based solely on mining.

Two major new mining areas emerged after World War II in northwestern Quebec. Though prospected in the 1930's, real development of Chibougamau copper 130 miles northwest of Lake St. John was delayed until the 1950's, but already it has become one of Canada's leading fields. Even more recent is the Mattagami zinc-copper (silver-gold) area discovered in 1957 some 80 miles north of Amos. First production was only in 1962-1963. These represent the easternmost mines yet developed in the heavily mineralized Timiskaming geological subregion. They illustrate the discontinuous nature of the mining frontier and its isolated spot penetration of the north in those areas removed from the main transportation net. In most cases they require connection with that net before development can occur.

It is in eastern Quebec and adjacent Labrador that the most spectacular mineral developments of all have taken place since World War II. In scope of development, transformation of the local landscape, and far-reaching effect on the nation as a whole, they are comparable only with those which occurred in northeastern Ontario-northwestern Quebec. Interior Labrador-Quebec has been transformed, drawn firmly into the ecumene of the nation, and this in turn has spurred activity in the Arctic beyond. Railways, the longest some 360 miles, have been the means of tapping immense iron ores associated with the north-south trending Labrador Trough. Of the several mining foci, Schefferville on the Lake Plateau has developed into a significant regional centre. Other new centres based on lower-grade ores include Labrador City, Wabush City and Gagnon, with continuing expansion under way. To permit shipment of the iron three new ore ports—Sept-Iles (the major port), Pointe Noir and Port Cartier—have been built on the Côte Nord since 1950, adding a further element to the economy of that area. All this development has occurred primarily because of the near-exhaustion of high grade Lake Superior iron ores.[27] Output is destined almost entirely for the United States steel industry both on the Lower Great Lakes and on the Atlantic seaboard. Canadian iron production in a few years has risen to such a high point that in 1964 for the first time it replaced nickel as the leading metallic mineral in value of production.

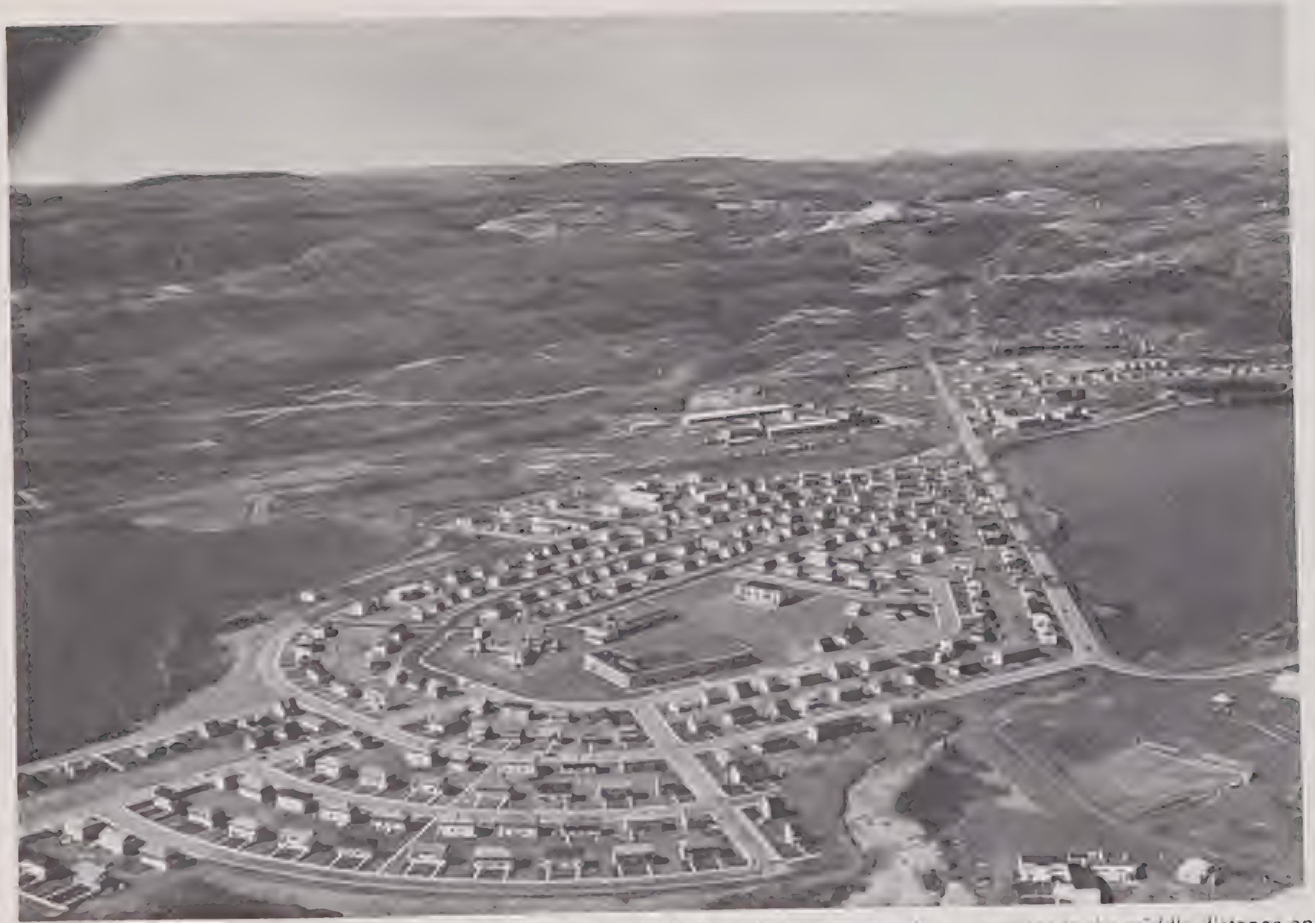
Also linked with the modern steel industry, titanium has come into production in the same period, east of Sept-Iles at Lac Allard. A 25-mile railway links it with the fourth new ore port in the area, at Havre St. Pierre, further transforming the Côte Nord. Eastward, however, the sparse population of fishermen-hunters continue the old way of life.

In the northwestern Subarctic, mining developments also occur, though in even more widely spaced areas. In northern Manitoba the close association of mines and railways is noteworthy. First of these mines still in production was at Flin Flon. Further extensions of this railway brought into production mines at Chisel Lake to the east, and Sherridan (now closed) and Lynn Lake to the north. One of the most important postwar changes has been the start of a very large nickel mining centre on Thompson, 140 miles north of the northern end of Lake Winnipeg. Here again, a rail spur from the Hudson Bay Railway provided the necessary transportation link.

In Canada's far northwest, three major mining areas have developed since the 1930's. Located far from the market and beyond the normal transportation facilities, they depended upon an unusual combination of air and inland water connections for shipment. Mines have been able to compete only with a high value mineral and unusually high quality ore body. Each of the three "great lakes of the north" has given rise to an important mining area, all on the Shield margin of the lakes: Great Bear Lake—silver, radium, uranium; Great Slave Lake—gold (with postwar lead-zinc from the southern non-Shield region); Athabasca Lake—gold, uranium. The associated mining centres have been Port Radium, Yellowknife and Uranium City, respectively. To date, only gold and in some cases high quality uranium have been able to avoid dependence upon railways in northern mining operations.

Between the Shield on the east and the Cordillera on the west, the central continental plains extend northward to the Arctic coast in a narrowing band, dominated by the Mackenzie drainage system. Though prospects for metallic minerals are limited, this sector is known to contain major fuel resources of oil and gas. At Norman Wells, a short distance south of the Arctic Circle, the continent's northernmost productive oilfield has been in operation since 1921, helping to reduce high fuel costs in the northwest. Since the 1947 Leduc oil discovery in Alberta, exploration activity has intensified between the two areas and extended even beyond Norman Wells out into the Arctic. In addition, the Oil Sands on either side of the Athabasca River below Fort McMurray are now in the first stage of development. The product will move southward, however, rather than be a basis for local industry. The petroleum potential of these sands is staggering: excluding oil shales, it is estimated that 626 billion barrels of reserves are present, of which 369 billion barrels are recoverable[28]—that is, over half (52 per cent) of the *world's* oil reserves! Introduction of extensive pipeline transportation nets in the past twenty years has made such Subarctic fuel resources much more attractive economically.

It is significant that the distribution of major mining areas in the Subarctic is broadening, rather than remaining in only a few areas. New mines coming into production each year, and new byproduct recoveries, have generally increased value of production and more than compensate for inevitable closures. Among the major Subarctic mining areas, only the Pine Point lead-zinc deposit lies outside the Shield. It is notable that except for the Labrador and Chibougamau areas, all



The Planned Modern Frontier town site of Schefferville, Quebec (55° N) with the open cast iron ore mines in the middle distance and the terrain of Labrador all around. (National Film Board: Photo by Jarrett.)

of the mining areas occur on the southern or outermost edges of the Shield and have been tapped from widely differing base points in settled Canada. The concentration of producing properties in the southern third of Canada is attributable to relatively easy access and thorough prospecting, but abundant rich mineral deposits may be expected to occur still farther north. At some point it would seem reasonable that access to such deposits might be made from the Arctic margins rather than further lengthening of the southward transportation links. This probably would be dependent upon overseas rather than continental markets.

Our northern mines have given rise to a distinctive settlement type. In some cases, particularly the more isolated and more recently developed, they have resulted in "company towns" as described before. More typical, until recently at least, was the development of a miscellaneous assortment of buildings in a casual array, inhabited by a constantly changing population seeking its fortune in the shortest possible time. Working people in the Canadian Subarctic include a significant percentage of immigrants, drawn from a variety of ethnic backgrounds. Many hope to earn a "grubstake" as soon as possible before moving on to their ultimate goal, usually outside the region. It remains to be seen whether the longer economic life expectancy of recent huge mining projects will change this attitude. The heterogeneity of the population in the mining communities imparts a further distinctive element to the Subarctic although it is not as marked in Quebec with its dominant French element. In the Thompson area of Manitoba, for example, the percentages of various European ethnic groups (with corresponding national percentages) in 1961 were British 42.7 (43.8), French 10.3 (30.4), German 9.4 (5.8), Italian 2.4 (2.5), Netherlands 2.8 (2.4), Polish 3.4 (1.8), Russian 1.6 (0.7), Scandinavian 7.1 (2.5), Ukrainian 10.0 (2.6), other Europeans 13.0 (3.3).[29]

Except in northern Ontario and northwestern Quebec, which are closer to the main centres of population and market and are served by relatively convenient transportation facilities, costs of mine development are high through much of the Subarctic. As latitude increases so do mine costs, particularly in the northwest. Yellowknife, for example, cannot afford to process ore with a gold content that would be acceptable for use in the Kirkland Lake area. It has been estimated that average incremental costs (costs of transportation to the property, of power, of services for employees) for most northern mines are approximately $4.75 per ton of ore mined over more southerly, though naturally this varies in specific cases.[30] The more remote mines often must tie up much capital in stockpiles of stores and parts, pay higher interest rates, pay bonus labour rates, pay more for fuel and use it longer because of the extended winter. If permafrost is not as continuous in the Subarctic as in the Arctic, it is more troublesome for any aspect of construction, mining or otherwise. The active layer of seasonal thaw is deep enough to produce severe structural problems of instability unless proper techniques are employed to cope with it. (Permafrost is not a serious problem underground in mining unless the property has been unworked for some time: under such conditions ice will accumulate on the walls.) All these complications add up to increased costs for northern mines and must be carefully considered before development. Still earlier, the ore body must have been proved extremely high grade and/or of vast quantity, and a guaranteed market must have been established.

The spectacular increase in value of Canadian mineral production is shown in Table 14-7. Earliest Canadian metal mining involved eastern Canada and Cordilleran Canada in the late nineteenth century, but the twentieth century has been dominated by the Subarctic Shield—that is, essentially the Subarctic. Many of its ore bodies are complex and required technological developments before they could be utilized. Similarly, the development of hydroelectricity within the region made possible processing of the minerals at or near the source. This not only increased the value of the product, but made utilization of some ore bodies feasible. While the start of smelting and refining occurred around the turn of the century, the major development took place in the late 1920's and early 1930's, with refineries installed in the region at places such as Copper Cliff and Flin Flon.[31] Today Canada has about twenty-four nonferrous smelters and refineries; roughly half are within the region. The majority of the others are in central Canada, not too far from where cheap hydroelectric power is available—for example, Montreal East and Port Colborne.[32] Generally during this century, the tendency has been toward increased processing of ores in Canada. An example of this is the completely integrated nickel mining development at Thompson, Manitoba: mining, concentrating, smelting and refining. This tendency has been checked during the past decade, however, with the enormous growth of iron ore production in the eastern Subarctic. Beneficiation of some of this ore is the only processing effected within Canada.

TABLE 14-7

VALUE OF PRODUCTION, SELECTED MINERALS OF CANADA ($ millions)

Mineral	1886	1891	1901	1911	1921	1931	1941	1951	1961	1964
Copper	0.4	1	6	7	6	24	64	149	255	328
Gold	1	0.9	24	10	19	58	206	162	159	144
Iron	0.1	0.1	—	0.7	2	—	1	31	188	403
Lead	—	—	2	1	4	7	15	58	47	54
Nickel	0.5	2	5	10	7	15	69	151	351	382
Silver	0.3	0.4	3	17	8	6	8	22	30	44
Zinc	—	—	—	0.1	2	6	17	136	105	193
Total value, Metallics				46	49	119	395	746	1,387	1,705
Total value, Mineral Production	10	19	66	107	103	172	560	1,245	2,582	3,397

Source: DBS, Ottawa.

The growth of the Canadian mining industry in this century has been due in part to the general growth of the nation, but its expansion to its present size is largely the result of foreign market demands, in western Europe and particularly in the United States. In recent years for example, 85 to 90 per cent of Canadian iron ore has been exported, about 95 per cent of its nickel, over 60 per cent of its copper and over 90 per cent of its zinc. The surge in Canadian mineral production since World War II is largely the result of the threatened exhaustion of high grade United States ores, and the American development of Canadian sources as replacements. It is becoming more and more expensive to develop a major mine, or even to prospect for one with modern equipment, as substantial sources of capital are required. The earlier mines in northern Ontario have provided some such sources but even in the 1920's at Flin Flon, American financial control was involved.[33] Increasingly, Canadian mines are looked to by American corporations to supply them with large-scale, reliable ore supplies. To provide the necessary capital and ensure smooth integration, United States ownership of Canadian mining, smelting and refining facilities has been growing to such a degree that it is provoking national debate in Canada. Both through the products of its forests and of its mines, the Subarctic is tied more to the United States today than it is to the rest of Canada.

HYDROELECTRICITY

Power resources of the Subarctic are impressive. The combustible fuels are concentrated in the Mackenzie Valley area of the northwest and have as yet been scarcely touched. The Shield and the western Cordilleran region are Canada's two greatest areas of hydroelectric power, the inheritance of its natural landscape. Fortunately, also, it is widely available. At the end of 1965, with about 22 million kilowatts of installed hydro generating capacity in all Canada there still remained probably twice as much undeveloped water power within the Subarctic.[34] Installed capacity within the region at that time was about 14 million kilowatts distributed as follows: Quebec 10 million kilowatts; Ontario 2.5 million kilowatts; Manitoba 1 million kilowatts; Saskatchewan 92,000 kilowatts; and in the Northwest Territories, 35,000 kilowatts.

Hydroelectric power has made possible the pulp and paper industry within the region, and most of the mining as well. In 1953, 21 per cent of all Canadian electric power was consumed by the pulp and paper industry, 4 per cent by mining and 18.7 per cent by smelting and refining. Hydroelectric power also has given rise to the electrometallurgical industry in the Quebec part of the Subarctic. There, near-ideal conditions exist for hydroelectric developments in the network of rivers and lakes descending over the Laurentide Scarp and in the great fault valley of the Saguenay. On the basis of abundant cheap power locally available, aluminum smelters have been established at such centres as Shawinigan Falls on the St. Maurice, Ile Maligne and Arvida on the upper Saguenay, and more recently at Baie Comeau on the Côte Nord. Together with Kitimat they have made Canada the second largest producer of primary aluminum in the world, of which 85 per cent is exported.

A great deal of the hydroelectricity development in the south-central parts of the Shield has been primarily for export beyond the Subarctic, to make possible much of the urban and industrial progress of southern Canada, especially in the provinces of Quebec and Ontario. The incessant demands for more power by those regions has resulted since World War II in the near-maximum utilization of all hydro power sources on the St. Lawrence slope of the Subarctic in Ontario and Quebec. Of note is the current development of the Bersimis River and the

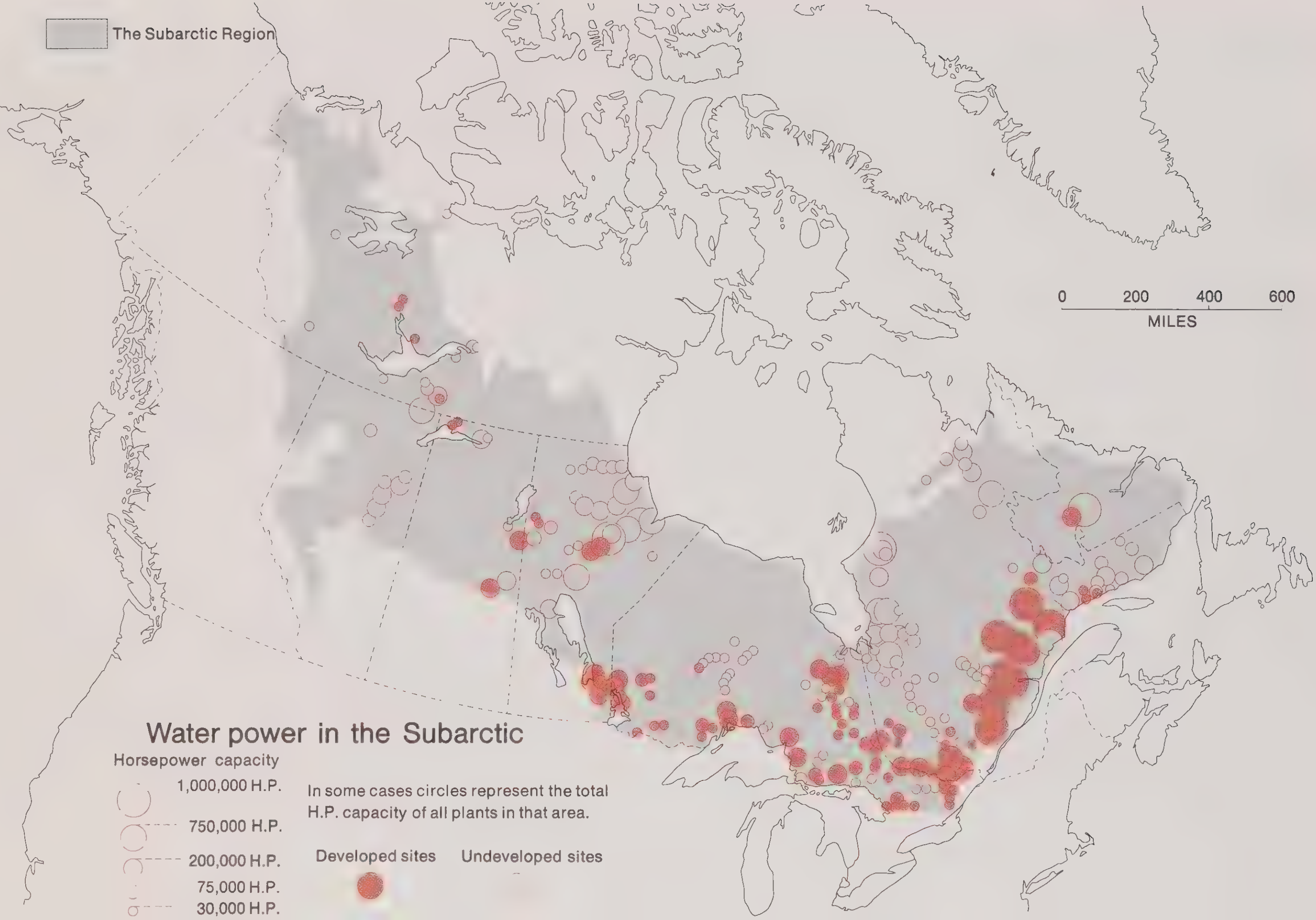

The Subarctic Region
0 200 400 600
MILES
Water power in the Subarctic
Horsepower capacity
1,000,000 H.P.
750,000 H.P.
200,000 H.P.
75,000 H.P.
30,000 H.P.
In some cases circles represent the total H.P. capacity of all plants in that area.
Developed sites
Undeveloped sites

Figure 14-4

multi-stage harnessing of the Manicouagan River, both on the Côte Nord. Similarly in Manitoba, Subarctic hydroelectric power development has been intended primarily to supply Winnipeg's needs, through installations on the Winnipeg River and in 1964 at Grand Rapids on the Saskatchewan River.

The federal government's recent approval for hydroelectric power to be exported to the United States has paved the way for the final massive stage in utilization of this resource. In the Subarctic, two major centres of potential development are involved—the Churchill (Hamilton) Falls in Labrador, which, with a possible installed capacity of more than 6 million horsepower, will become the largest hydroelectric development in the world, and the multi-stage Nelson River project in Manitoba. The gigantic power developments (as with the vast Subarctic mineral developments) demand enormous capital investment and large guaranteed markets. The Labrador project is linked with export to the northeast of the United States, while that in Manitoba is aimed at the American Midwest. Long-distance transmission of such power has become feasible in postwar years as a result of new technological knowledge—for example, the 735 k.v. transmission line (the highest voltage in the world) now in operation between Manicouagan and Montreal.[35] It is significant that hydroelectricity appears to be joining the products of Subarctic forestry and mining in major export to the United States. Government, however, is much more directly involved in hydroelectricity than in the other two industries. Provincial government agencies, aided in some cases by federal funds, are now dominant in the development of these massive blocks of hydroelectric power.

TRANSPORTATION

None of these changes in the Canadian Subarctic would have occurred had there not been major improvements in transportation throughout the region. Water transportation, the original and only significant means for centuries, now persists economically only in the extreme northwest, in the Mackenzie Valley region focusing its major base on Edmonton. (Its importance on the margins of the Subarctic continues, however, especially in the Great Lakes-St. Lawrence region and to a much lesser degree in the Arctic.) As newer transportation roads and railways have moved northward, even the Mackenzie waterway has had to adapt. Increasingly efficient service, however, has enabled it to survive, and it probably will continue to handle certain commodities.

Railways were regarded as an essential means of overcoming the harsh "wasteland" of the Subarctic and of tying together the "valuable" parts of the nation at the time of Confederation. The necessity of detouring round the Shield by way of the United States in any trip between southern Ontario and the Prairies was rankling. The Dawson Road attempted to pierce the barrier, but it was appreciated that only a railway would provide satisfactory links between the widely separated elements making up the new nation. Since then, as noted, they have proved major instruments in the conversion of much of that same wasteland into important centres of production. This has been especially true of the mining development, and indeed has been essential for most of those mines producing non-precious metals. Though railways cannot be constructed in the Shield as easily as on the plains because of frequent rock cuts and twisting routes to avoid lakes and muskeg, the problem is at least less expensive than in the Cordilleran region. Yet it was in the Cordilleran-Subarctic area that the first northern railway was built in Canada to facilitate a mining development, the Klondike. Since then the northward-probing railways have frequently facilitated mining developments.

The construction of the Hudson Bay Railway to a Hudson Bay terminus at Churchill in 1929 and the extension of the Timiskaming and Northern Ontario Railway to Moosonee on James Bay in 1932 re-established the two centres as seaports. Completion did not guarantee the great developments which many hoped or expected would follow. They have meant little to the Subarctic in subsequent years. Traffic north of Cochrane failed to materialize in any quantity, and when Moosonee was discussed in the 1960's as a possible receiving port for southbound Arctic ore, great concern was expressed about its suitability as a harbour. Churchill and the Hudson Bay Railway were intended to exploit the geographical fact that prairie grain bound for Britain travelled an appreciably shorter distance by way of Hudson Bay than by the St. Lawrence. Despite active promotion, the Hudson Bay route has been slow to develop for a variety of reasons—short season and opposition of eastern shipping and insurance interests, to name but two. In 1965, 49 ships carried off almost 25 million bushels of grain, but this was still far short of the dazzling goal originally envisaged. Postwar development of the Thompson nickel ore body marked the first major project related to the railway.

In the 1950's and 1960's mining railways have been constructed to the north—to Lynn Lake in Manitoba, to Schefferville, Labrador City, to Wabush City, to Gagnon in Quebec-Labrador, and to Pine Point in the Northwest Territories. This railway expansion in the Subarctic contrasts with other parts of Canada where smaller railway lines are being closed. Some 3,000 miles of new rail lines have been built in Canada since World War II, primarily for Subarctic mining development.

Mineral activity was greatly increased by the development of aircraft, particularly helicopters, which brought about new prospecting methods such as aerial photography, affecting scientific exploration and mapping. Through this approach since 1920, Red Lake in northern Ontario, all the mining centres of the Mackenzie Valley area and the interior Quebec-Labrador area came into existence. As production began, cheaper forms of ground transport were required although the mines north of Yellowknife still rely on air-transport. As a major mining centre developed, ground facilities improved and scheduled flights by larger aircraft followed. Several such lines now extend northward across the Subarctic, from such bases as Edmonton, Winnipeg, Montreal and Rimouski.

Roads have been built northward into the Subarctic from southern Canada. These were limited at first to the more populous and accessible central sectors. During the 1930's, beyond the regular roads, "cat trains" operated out over frozen lakes and muskeg with supplies for isolated centres.[36] After World War II, many isolated centres demanded road connections with the "outside" even if hundreds of miles were involved. Two stages are observable: construction of a winter road involving rough clearing of the route with a bulldozer, and packing of snow to the point where wheeled vehicles can use it—mainly large tractor-trailer type highway trucks, but some automobiles (particularly taxis!); then, improvement of the winter road eventually to all-weather standards. This road succession has been particularly striking in the Mackenzie Valley area where winter roads, normally usable from early January to late April, have displaced the cat trains entirely, which in turn have retreated farther north.[37] Wheeled vehicles now can reach Inuvik in the Delta during the winter, and for several years have served Great Bear Lake, and even regularly supply Canada's first Arctic gold mine beyond the tree-line northeast of Yellowknife.

URBAN ORGANIZATION

Although urban centres of modest size are present in the Subarctic, because of its great extent no major centre has emerged as the focus of the region. Instead, it is dependent upon four "outside" cities on its southern margins: Edmonton, Winnipeg, Montreal and Toronto. While all four provide specialized services for the Subarctic, financing remains primarily centred in Montreal and Toronto.

Internally the region is organized mainly around the urban foci of local transportation and related activities. These include Sept-Iles, North Bay, Sault Ste. Marie, Cochrane, Port Arthur, Fort William, Kenora, The Pas, Fort McMurray and Hay River. Kenogami, Kapuskasing and Fort Frances are specialized centres concerned with manufacture of pulp and paper. Chibougamau, Noranda-Rouyn, Arvida, Kirkland Lake, Steep Rock, Flin Flon, Uranium City contain mining and/or smelting, and Fort Smith and Inuvik are concerned with administration. Goose Bay was established during World War II as an air base for North Atlantic flights. The life-expectancy of mining communities has been traditionally limited, but it is lengthened when they are able to provide specialized services for newer mining areas. The size of Timmins (1961: 29,270), for example, is partially due to the fact that it can provide experienced mining specialists such as diamond drill teams wherever they may be required in the north. Though younger mining towns than Timmins, Yellowknife and Schefferville have already developed from being solely mining camps to the point where they are providing service to newer outlying mines and prospects. The major concentration of urban centres is between Quebec and Winnipeg, and from the CNR Transcontinental southward. Clearly it is along the vital transportation "bridge lines" between eastern and western Canada that the greatest inducements to Subarctic urban growth have occurred.

Within the entire region there was only one city with over 50,000 population reported in the 1961 Census: Sudbury (80,120). Including closely related centres it and Chicoutimi (42,866) are the foci of northern conurbations which in 1961 contained about 100,000 population each. (The Lakehead with a 1961 population of 90,000 in the combined cities of Fort William and Port Arthur approached this size.) Both Sudbury and Chicoutimi owe their predominance to a combination of favourable factors which have not yet been matched elsewhere in the Subarctic.

In Sudbury's case its strategic situation relative to rich nickel-copper ores and to major rail lines have been dominant. Chicoutimi has flourished with local forest resources, agriculture and abundant hydroelectric power.

OTHER ACTIVITY

Transportation in itself has provided additional bases for population in the Subarctic. Railway maintenance camps and towns were the earliest of these and probably still are the most noteworthy, though other media also have supported local inhabitants. Divisional points or transshipping centres, of which the Lakehead cities of Fort William and Port Arthur are classic examples, have been especially important.

Communications in the north have long been characterized by their absence or unreliability. Radio communications, such as the net established down the Mackenzie Valley in the 1920's by the Royal Canadian Corps of Signals, did much to improve this problem. Within the past decade, improvements in telecommunications have made major advances: tropospheric scatter systems, microwave relay systems and high frequency radio now make possible rapid and efficient contact between the "outside" and any point in the Subarctic with proper equipment.

With all the change that has occurred in the Subarctic in the century since Confederation, the three major activities at that time, hunting, fishing and trapping, continue to occupy some of the resident population. This is particularly true of the Indian inhabitants. Today, however, with perhaps 45,000 to 50,000 involved, the Indians are a minority among the total population. In some areas, such as the northern Prairie provinces and Great Slave Lake, commercial fishing has become a significant economic activity; but this is unusual. Trapping was sufficiently profitable in the depression and World War II years to provide not only good living conditions for the Indians but also to attract some white men. Since the war, however, declining fur prices, competition from synthetics and rising costs of living have discouraged many of the native peoples. Many areas have been overhunted, and caribou have declined disastrously in numbers and even disappeared entirely in some sectors. The general result, however, is that except in some unusually productive fur areas, like the beaver areas near James Bay and muskrat in the Mackenzie Delta, the former hunters, fishermen and trappers have congregated increasingly in the settlement nuclei. There, ill-equipped for the modern world, the inheritors of a shattered culture, many lose their independence and pride and often unfortunately encounter discrimination. Great stress is now placed on improved education as the ultimate solution for this tragic problem, but the difficulties are many.

Governmental establishments have become significant features in the Subarctic, as elsewhere in Canada. The wide range of functions involved includes schools, mining recorders' offices, police detachments, meteorological-radio stations and welfare offices. In a region with smaller total numbers of population and fewer economic activities, they play a more significant role than in southern Canada generally. In an extreme case, the western Arctic and Subarctic administrative centre of Inuvik in the Mackenzie Delta provides the sole base of a community.

Forest, lakes and sparse population are attracting people in growing numbers as visitors to the Subarctic. Recreation demands are increasing everywhere and the impact on this region is significant. The southern margin in central Canada especially has been utilized for recreation by the large nearby urban centres for over fifty years, though tourists visited the Subarctic much earlier. The automobile widened the range of vacations. Since World War II increased income and longer vacation periods have made it possible for unprecedented numbers to seek out favoured recreation areas, and camping and boating enthusiasts abound. While greatest pressures are still on the more southerly margins of the Subarctic, aircraft have made all parts accessible and support local establishments ranging from goose hunting on James Bay to fishing on Great Bear Lake.

SUMMARY

This is the Subarctic today. Population has increased markedly, but compared with the rest of Canada (other than the Arctic) it is still small in total. Moreover, there are probably more areas truly empty than a hundred years ago when the Indians ranged more widely. Population is characteristically grouped into small clusters usually concerned with monofunctional activity, though a few are more diversified. Separating them are large, relatively undisturbed forest areas. Despite their separation from "settled Canada" and the harsh environment, particularly the long severe winter, the white inhabitants demand and obtain almost identical living conditions to those of southern Canadians. The possibilities of developing new forms and patterns better-suited to the region, and costing less, are not attractive to most. Many of the inhabitants regard their presence in the Subarctic as a temporary thing, if not a period of banishment from southern Canada. For some, more advanced educational facilities are becoming increasingly available—for example, by way of the establishment of Laurentian University at Sudbury in 1957.

Many of the original problems of the Subarctic remain—vast distance, isolation, cold climate, rocky environment. Some new ones may even have been created. The fragmented development of different local resources has contributed to the emergence of separate sectors within the Subarctic.

Despite many common features throughout the region, the Subarctic really lacks a strong core to give it a cohesive identity. In such a large region perhaps fragmentation is inevitable, and advantages and disadvantages debatable. At the present time it would seem that some eleven sectors are identifiable: the Labrador Plateau, La Côte Nord, Lake St. John-Saguenay, Abitibi-Timiskaming, Northeast Ontario, the Sudbury Basin, the Sault Shore, Northwest Ontario, Northern Manitoba, the Mackenzie Valley area and the Central Yukon (in the overlapping Cordilleran Subarctic sector).

Despite fragmentation, many common problems occur through the Subarctic which will need to be solved during the next century. Until recently it has remained a producer of raw materials and power for the rest of Canada, and since World War II increasingly for the United States. Indeed, American rather than

Canadian decisions may primarily decide the future of the Subarctic. To what extent can or should more planning, regional and national, be introduced for future developments, settlements, transportation and communication services? Finally, what is the role of the native population to be in this future? Having contributed their land and even its name to the nation, they have a right to expect that they will be included as full partners in the developments to come.

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and yet within its boundaries is only .05 per cent of the population. The significance of this minute proportion is heightened when it is recognized that the population of the Arctic has not only decreased in relation to the total population of the country in the last century, but has also shrunk in absolute numbers. Today there are considerable areas unoccupied that a hundred years ago supported a native population.

The existence of the Canadian Arctic has rarely influenced public thought in southern Canada. Indeed until the last two decades, the Arctic was a forgotten land, for which only a handful of individuals felt any responsibility. Few forecast that it would make a positive contribution to the future development of Canada. Since 1945 there has been a growing consciousness of the north. In the early years this was linked with recognition of the dangerous proximity of the Soviet Union across the polar basin, for parts of Arctic Canada are closer to Russia than Montreal is to Winnipeg; whereas the basin had once been an impossible barrier,

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* J. B. Bird is a Professor of Geography at McGill University, Montreal.

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